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ABSTRACT

The Memphis City School System was notified by Memphis Light, Gas, and Water that it was necessary to reduce its consumption of natural gas during the winter of 1975-76. A survey was developed and sent to 44 large public school systems to determine which methods of heating energy conservation were used most frequently and which methods were most successful. Completed surveys have been received from 31 (70 percent) of the school systems. The three most frequently used methods of heating energy conservation were (1) reduce building temperatures during holiday periods, (2) place stronger emphasis on proper maintenance of heating equipment, and (3) reduce building temperature. The four methods of heating energy conservation that were perceived as highly successful were the above first two plus (3) switch to night heating cycle before school closes for the day, and (4) schedule custodial care during the day instead of night. (Author/MLF)

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METHODS OF CONSERVING HEATING ENERGY UTILIZED IN THIRTY-ONE PUBLIC SCHOOL SYSTEMS

JANUARY, 1976

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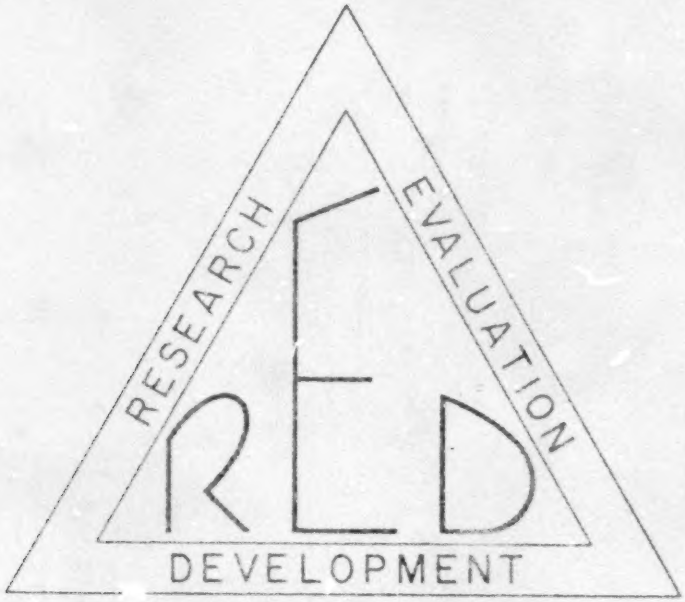

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IN THIRTY-ONE PUBLIC SCHOOL SYSTEMS
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Abstract

The Memphis City School System was notified by Memphis Light, Gas, and Water that it was necessary to reduce its consumption of natural gas during the winter of 1975-76. The Memphis school system was probably not unlike other large school systems relative to the need to conserve heating energy or face additional utility costs. A survey entitled, "Methods of Conserving Heating Energy," was developed and sent to 44 large public school systems to determine which methods of heating energy conservation were used most frequently and which methods were most successful.

Completed surveys have been received from 31 (70%) of the 44 public school systems. Data from these surveys indicate that most (75%) of the responding school systems had student enrollments of between 50,000 and 140,000. Most (75%) school systems reported that their primary source of heating energy was natural gas, and many (84%) responded that electricity was one of their secondary sources of heating energy. Most (87%) respondents reported that their school systems' fuel allocation had not been reduced since the 1972-73 school year.

Each respondent was requested to (1) indicate the percent of schools in which each of 23 methods of heating energy conservation was used and (2) rate (on a scale of 1 to 5) the perceived success of each of the 23 methods. As reported by the 31 responding school systems, the three

most frequently utilized methods of heating energy conservation were: (1) reduce building temperature during holiday periods; (2) place stronger emphasis on proper maintenance of heating equipment; and (3) reduce building temperature. Approximately 93% of the respondents utilized to some extent these three methods. Those four methods of heating energy conservation which were perceived as highly successful were: (1) reduce building temperature during holiday periods; (2) switch to night heating cycle before school closes for the day; (3) schedule custodial care during the day instead of night; and (4) place stronger emphasis on proper maintenance of heating equipment.

ACKNOWLEDGEMENTS

The Memphis City School System wishes to convey thanks to the representatives of the thirty-one public school systems who responded to the survey, "Methods of Heating Energy Conservation." Information derived from the survey offers much that is relevant to the need to conserve energy. A special thanks is extended to those who also provided the Memphis school system with additional printed materials pertinent to their efforts of energy conservation.

The author is also indebted to Maurice E. Roach, Director, Federal and State Projects, and to Ben Chipley, Assistant Director, Plant Maintenance for their technical assistance and recommendations relative to the development of the survey instrument and to the writing of this document.

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METHODS OF CONSERVING HEATING ENERGY UTILIZED
IN THIRTY-ONE PUBLIC SCHOOL SYSTEMS
JANUARY, 1976

Introduction

The Memphis City School System was notified by Memphis Light, Gas, and Water that it was necessary for the school system to reduce its consumption of natural gas by as much as 25% during the period of November, 1975 through March, 1976. The school system faced a penalty of $5.80 per 1000 cubic feet of natural gas consumed above the allotted amount if it did not reduce its consumption during the specified time period. The Memphis school system was probably not unlike other large school systems relative to the need to conserve heating energy or face additional utility costs.

In order to determine the methods used by other large public school systems to reduce heating energy consumption and to reduce utility costs, a survey entitled, "Methods of Conserving Heating Energy," was developed. A copy of the survey instrument and the accompanying letter which were sent to 44 public school systems are shown in the Appendix. The specific purposes of the survey were (1) to determine which methods of heating energy conservation were utilized most frequently and (2) to determine the perceived success of each method of heating energy conservation. Additionally, each respondent was asked: (1) whether or not the school system's fuel allocation had been reduced since the 1972-73 school year; (2) what specific penalties were imposed if the allocation were exceeded; (3) what the primary source of energy for heating purposes was; and (4) to include other printed materials relative to methods of energy conservation.

Procedures

The "Methods of Heating Energy Conservation" survey was mailed to each of the business managers of 44 public school systems on December 5, 1975. Respondents were requested to reply to the survey on or before Friday, December 19, 1975. The 44 public school systems were identified as the 44 largest public school systems (in terms of student enrollment) according to a list entitled, "Population, School Population, Superintendents, and Directors of Research in Largest Cities in the U.S. (Also Includes Largest Cities in Texas) - February, 1974."

Each respondent was asked to return the completed survey to the Division of Research and Planning, Memphis City School System, Memphis, Tennessee 38112. A self-addressed, stamped, return envelope was provided for replies. Each respondent was also given the opportunity to indicate whether or not his school system wanted the results of the survey.

The survey was divided into two parts. Part I contained six items relative to the size of the school system and sources of heating energy. Part II contained a list of 23 methods of heating energy conservation. Each respondent was requested to determine for each of the 23 methods of heating energy conservation the extent to which the method was used in his school system and his rating of the success of each method utilized.

Results

As of January 30, 1976, the Division of Research and Planning of the Memphis City School System has received completed surveys from 31 (70%) of the 44 public school systems. Table 1 is a list of school

systems from which completed surveys were received.

Part I Background Information

The frequency and percent of responses to the six questions in Part I of the survey are displayed in Table 2. The following discussion is based on the data shown in Table 2.

Student enrollment. The range of the size of the school systems was between 50,000 students and 260,000+ students. However, approximately 77% (24 of the 31 school systems) of the school systems reported student enrollments of less than 140,000. Five school systems (16%) reported student enrollments in excess of 200,000. Note that two school systems (6%) did not report student enrollment data.

Number of school plants. The range of the number of school plants was between 80 and 500+. Approximately 58% (18) of the school systems reported having between 80 and 149 school plants. Approximately 36% (11) of the school systems had between 150 and 360 school plants. and two school systems reported having in excess of 500 school plants.

Primary heating energy source. Approximately three-fourths (23) of the school systems utilized natural gas as the primary source of heating energy. Approximately 23% (7) of the school systems utilized fuel oil as the primary source of heating energy, and one system (3%) utilized coal as a primary heating source. No school system reported utilizing either propane gas or electricity as the primary source of energy for heating purposes.

Other heating energy sources. Almost 84% (26) of the respondents reported that electricity was one of the other sources of heating energy. Approximately 45% (14) of the school systems reported that

TABLE 1

SCHOOL SYSTEMS FROM WHICH COMPLETED SURVEYS WERE RECEIVED

	SCHOOL SYSTEM	CITY
1.	Albuquerque Public Schools	Albuquerque, New Mexico 87106
2.	Atlanta Public Schools	Atlanta, Georgia 30303
3.	Board of Education of Baltimore County	Baltimore, Maryland 21204
4.	Charlotte-Mecklenburg Schools	Charlotte, North Carolina 28230
5.	Cincinnati Public Schools	Cincinnati, Ohio 45206
6.	Clark County School District	Las Vegas, Nevada 89121
7.	Columbus Public Schools	Columbus, Ohio 43215
8.	Dade County Public Schools	Miami, Florida 33132
9.	Dallas Independent School System	Dallas, Texas 75204
10.	Dekalb County Board of Education	Tucker, Georgia 30084
11.	Duval County School Board	Jacksonville, Florida 32210
12.	Houston Independent School District	Houston, Texas 77027
13.	Indianapolis Public Schools	Indianapolis, Indiana 46204
14.	Los Angeles Unified School District	Los Angeles, California
15.	Milwaukee Public Schools	Milwaukee, Wisconsin 53201
16.	Minneapolis Public Schools	Minneapolis, Minnesota 55413
17.	Nashville Metropolitan Public Schools	Nashville, Tennessee 37204
18.	New Orleans Public Schools	New Orleans, Louisiana 70126
19.	New York City Board of Education	Long Island City 11101
20.	Newark Board of Education	Newark, New Jersey 07102
21.	Orange County School System	Orlando, Florida 32802
22.	Palm Beach Co. Public School System	West Palm Beach, Florida 33402
23.	Prince George's County Public Schools	Upper Marlboro, Maryland 20870
24.	San Antonio Independent School District	San Antonio, Texas 78208
25.	St. Louis Public School System	St. Louis, Missouri 63101
26.	San Diego Unified School System	San Diego, California 92103
27.	San Francisco Unified School District	San Francisco, California 94102
28.	School Board of Pinellas County	Clearwater, Florida 33520
29.	School District of Philadelphia	Philadelphia, Pennsylvania 19103
30.	Seattle School District No. 1	Seattle, Washington 98109
31.	Tulsa Public Schools	Tulsa, Oklahoma 74145

TABLE 2

FREQUENCY AND PERCENT OF RESPONSES TO BACKGROUND INFORMATION ITEMS (N=31)

PART I

1. Number of students enrolled (ADA) for 1975-76 school year

Student Enrollment	Frequency	Percent	Student Enrollment	Frequency	Percent
50,000 to 59,999	1	3.2	120,000 to 129,999	2	6.5
60,000 to 69,999	4	12.9	130,000 to 139,999	2	6.5
70,000 to 79,999	4	12.9	200,000 to 209,999	1	3.2
80,000 to 89,999	7	22.6	250,000 to 259,999	2	6.5
90,000 to 99,999	2	6.5	260,000 +	2	6.5
100,000 to 109,999	1	3.2	No Response	2	6.5
110,000 to 119,999	1	3.2			

2. Approximate number of school plants

School Plants	Frequency	Percent	School Plants	Frequency	Percent
80-89	1	3.2	170-179	3	9.7
90-99	2	6.5	180-189	1	3.2
100-109	6	19.4	230-239	1	3.2
120-129	4	12.9	240-249	1	3.2
130-139	4	12.9	250-259	1	3.2
140-149	1	3.2	350-359	1	3.2
150-159	2	6.5	500 +	2	6.5
160-169	1	3.2			

3. What is the school system's primary source of energy for heating purposes?

Energy Source	Frequency	Percent	Energy Source	Frequency	Percent
a. natural gas	23	74.2	d. electrical	0	0.0
b. propane gas	0	0.0	e. coal	1	3.2
c. fuel oil	7	22.6	f. other	0	0.0

TABLE 2
(continued)

4. What other sources of energy for heating purposes are utilized?

Energy Source	Frequency	Percent	Energy Source	Frequency	Percent
a. natural gas	9	29.0	d. electrical	26	83.9
b. propane gas	5	16.1	e. coal	9	29.0
c. fuel oil	14	45.2	f. other (steam)	3	9.7

5. Has the school system's fuel allocation been reduced since the 1972-73 school year?

Response	Frequency	Percent
a. yes	4	12.9
b. no	27	87.1

If yes, by what percent was the fuel allocation reduced for each school year?

School Year	Percent Reduction	Frequency	School Year	Percent Reduction	Frequency
a. 1972-73	11	1	d. 1975-76	10	1
b. 1973-74	10	1		20.25	1
c. 1974-75	10	1		40	1
	40	1		6 days	
	6 days	1			

6. If the school system has a fuel allocation what specific penalties will be imposed by the supplier if the allocation is exceeded?

"$10.00 Per MCF Exceeding Allocation of Natural Gas."

"$10.00 per thousand cu. ft. of overage used."

"Any interruptible gas used during a period of curtailment is charged at a penalty rate of $0.60 per therm."

"1. Do not have specific allocation for natural gas.
2. Fuel oil and gasoline allocation based on adjusted 1972 base year consumption/has not been strictly enforced since supply has been plentiful since winter of 73-74."

TABLE 2
(continued)

6. <u>If the school system has a fuel allocation what specific penalties will be imposed by the supplier if the allocation is exceeded?</u>

"Interruptible gas classification implies an allocation if exceeded penalty can be ten times normal rate or complete shut-off."

"For each CCF over use $1.00 charge to user."

"PSC is holding hearings on possible rate changes."

"As far as it can be ascertained, it is believed that the 1972-73 allocation remains in effect although due to extremely mild weather, there has been no recent directives received from controlling agencies on this matter. For your further information, the Duval County school system has consistently remained below the fuel allocation due to mild weather and also due to a program of diversification of energy sources. For example, we have converted 49 school plants from fuel oil to natural gas. This diversification of energy sources has relieved the pressure on the fuel oil allocation and since we are an uninterrupted customer on natural gas, it is not believed that any future fuel oil allocations will affect the Duval County school system. As far as penalities are concerned, there are no specific penalities for exceeding the fuel oil allocation. The situation is simply that if we reach or exceed the fuel oil allocation, deliveries are halted."

"$1.00/CCF/school site or if allocation is exceeded more than 5% at any location."

"No new installation of gas or electric heating permitted."

fuel oil was a secondary source of heating energy. Other secondary sources of heating energy utilized by fewer than 30% (9) of the systems were; (1) natural gas and coal (29%), (2) propane gas (16%), and (3) steam (10%).

Reduction in fuel allocation since 1972-73. Most (87%) of the respondents reported that their school systems' fuel allocation had not been reduced since the 1972-73 school year.

Part II - Usage of Heating Energy Conservation Methods

Table 3 contains the frequency and percent of use of each of the 23 methods of heating energy conservation. (Each respondent was requested to indicate the percent of schools in which each method of heating energy conservation was used. Possible categories of response were: (1) 0%, not used; (2) 1-25%; (3) 26-50%; (4) 51-75%; (5) 76-99%; and (6) 100%.) For example, Table 3 shows that on Item 1, 29 respondents (94%) reported that shortening the school day by reducing lunch or activity periods was not a method utilized to conserve heating energy.

Table 4 shows the 23 methods of heating energy conservation ranked according to frequency of usage. A weighted average for each method was computed by assigning a weight of 0, 1, 2, 3, or 4 to the percent categories of 0%, 1 to 25%, 26 to 50%, 51 to 75%, and 76 to 100%, respectively. Thus, the weighted average for each method of heating energy conservation shown in Table 4 could range from 0 to 4. Note that the numeral in parentheses after each item in Table 4 shows the number of persons who responded to the item. The following discussion is based on the data shown in Tables 3 and 4.

TABLE 3

FREQUENCY AND PERCENT OF USAGE AND SUCCESS FOR EACH METHOD OF HEATING ENERGY CONSERVATION (N=31)

Method of Heating Energy Conservation	Percent of Schools the Method Is (Has Been) Used							Your Rating of the Success of the Method					
	Not Used 0%	1-25%	26-50%	51-75%	76-99%	100%	No Response	Low 1	2	3	4	High 5	No Response
1. Shorten school day by reducing lunch periods or activity periods.	29*	1	0	0	0	0	1	0	1	0	0	0	1
	93.5**	3.2	-	-	-	-	3.2	-	3.2	-	-	-	3.2
2. Reduce athletic or special activity practices during after school hours (weekends, holidays, etc.)	20	6	0	1	0	3	1	4	0	0	2	2	3
	64.5	19.4	-	3.2	-	9.7	3.2	12.9	-	-	6.5	6.5	9.7
3. Conduct staff training workshops, relative to heating energy conservation methods.	13	3	1	2	1	10	1	2	2	7	2	4	1
	41.9	9.7	3.2	6.5	3.2	32.3	3.2	6.5	6.5	22.6	6.5	12.9	3.2
4. Install storm windows (or double glaze) or reduce number of windows in school unit.	22	7	0	0	0	1	1	1	0	2	1	2	3
	71.0	22.6	-	-	-	3.2	3.2	3.2	-	6.5	3.2	6.5	9.7
5. Utilize heat recovery methods.	25	3	2	0	0	0	1	0	0	2	2	1	1
	80.6	9.7	6.5	-	-	-	3.2	-	-	6.5	6.5	3.2	3.2
6. Reduce building temperature.	2	1	4	1	3	19	1	3	1	10	5	7	3
	6.5	3.2	12.9	3.2	9.7	61.3	3.2	9.7	3.2	32.3	16.1	22.6	9.7
7. Reduce temperature in specialized areas such as gymnasiums, auditoriums, etc.	5	4	2	1	2	16	1	2	1	9	5	6	3
	16.1	12.9	6.5	3.2	6.5	51.6	3.2	6.5	3.2	29.0	16.1	19.4	9.7

*Indicates the frequency of the response.
**Indicates the percent of the response.

TABLE 3
(continued)

Method of Heating Energy Conservation	Percent of Schools the Method Is (Has Been) Used							Your Rating of the Success of the Method					
	Not Used 0%	1-25%	26-50%	51-75%	76-99%	100%	No Response	Low 1	2	3	4	High 5	No Response
8. Delay building warm-up periods until closer to opening of school for the day	9	4	3	2	1	11	1	3	1	5	5	6	2
	29.0	12.9	9.7	6.5	3.2	35.5	3.2	9.7	3.2	16.1	16.1	19.4	6.5
9. Switch to night heating cycle before school closes for the day.	6	2	1	6	3	11	2	0	1	2	7	11	4
	19.4	6.5	3.2	19.4	9.7	35.5	6.5	-	3.2	6.5	22.6	35.5	12.9
10. Reduce building temperature during holiday periods.	1	1	0	0	3	25	1	0	0	5	3	19	3
	3.2	3.2	-	-	9.7	80.6	3.2	-	-	16.1	9.7	61.3	9.7
11. Reduce heating in hallways.	12	3	1	2	2	10	1	1	1	9	2	4	2
	38.7	9.7	3.2	6.5	6.5	32.3	3.2	3.2	3.2	29.0	6.5	12.9	6.5
12. Schedule custodial care during day instead of night.	22	1	1	2	2	2	1	0	1	1	1	4	2
	71.0	3.2	3.2	6.5	6.5	6.5	3.2	-	3.2	3.2	3.2	12.9	6.5
13. Reduce community use of buildings during after school hours.	20	3	2	0	0	5	1	1	2	4	0	3	1
	64.5	9.7	6.5	-	-	16.1	3.2	3.2	6.5	12.9	-	9.7	3.2
14. Prohibit the use of portable heaters and other such high energy consuming small appliances.	16	2	0	3	2	7	1	4	3	3	2	2	1
	51.6	6.5	-	9.7	6.5	22.6	3.2	12.9	9.7	9.7	6.5	6.5	3.2
15. Schedule extra-curricular events and community events simultaneously.	20	3	2	2	1	2	1	2	1	5	1	1	1
	64.5	9.7	6.5	6.5	3.2	6.5	3.2	6.5	3.2	16.1	3.2	3.2	3.2

TABLE 3
(continued)

Method of Heating Energy Conservation	Percent of Schools the Method Is (Has Been) Used							Your Rating of the Success of the Method					
	Not Used 0%	1-25%	26-50%	51-75%	76-99%	100%	No Response	Low 1	2	3	4	High 5	No Response
16. Install double doors.	24	2	1	2	0	0	2	0	1	2	0	2	2
	77.4	6.5	3.2	6.5	-	-	6.5	-	3.2	6.5	-	6.5	6.5
17. Weather strip all windows and doors.	21	5	1	0	1	1	2	1	3	2	1	1	2
	67.7	16.1	3.2	-	3.2	3.2	6.5	3.2	9.7	6.5	3.2	3.2	6.5
18. Insulate ducts, hot water pipes, ceilings, walls, etc.	9	7	1	4	1	7	2	3	3	3	3	8	2
	29.0	22.6	3.2	12.9	3.2	22.6	6.5	9.7	9.7	9.7	9.7	25.8	6.5
19. Open window coverings during day for heat and light and close during night.	19	3	1	1	2	4	1	1	2	4	3	0	2
	61.3	9.7	3.2	3.2	6.5	12.9	3.2	3.2	6.5	12.9	9.7	-	6.5
20. Place stronger emphasis on proper maintenance of heating equipment.	2	1	2	3	1	21	1	1	1	6	8	11	2
	6.5	3.2	6.5	9.7	3.2	67.7	3.2	3.2	3.2	19.4	25.8	35.5	6.5
21. Prepare "cold" lunches occasionally.	25	1	0	2	0	2	1	1	1	3	0	0	1
	80.6	3.2	-	6.5	-	6.5	3.2	3.2	3.2	9.7	-	-	3.2
22. Reduce and control length of showers in locker rooms.	23	4	1	1	1	0	1	1	1	2	2	1	1
	74.2	12.9	3.2	3.2	3.2	-	3.2	3.2	3.2	6.5	6.5	3.2	3.2
23. Reduce temperature of hot water.	15	3	1	3	0	7	2	0	1	4	4	5	2
	48.4	9.7	3.2	9.7	-	22.6	6.5	-	3.2	12.9	12.9	16.1	6.5

TABLE 4

RANK ORDER OF EACH METHOD OF HEATING ENERGY CONSERVATION ACCORDING TO USAGE RATING

Item	Rank	Item Number	Weighted Average**
Reduce building temperature during holiday periods. (30)*	1	10	3.77
Place stronger emphasis on proper maintenance of heating equipment. (30)	2	20	3.40
Reduce building temperature. (30)	3	6	3.33
Reduce temperature in specialized areas such as gymnasiums, auditoriums, etc. (30)	4	7	2.77
Switch to night heating cycle before school closes for the day. (29)	5	9	2.69
Delay building warm-up periods until closer to opening of school for the day. (30)	6	8	2.13
Reduce heating in hallways. (30)	7	11	1.97
Conduct staff training workshops, relative to heating energy conservation methods. (30)	8	3	1.83
Insulate ducts, hot water pipes, ceilings, walls, etc. (29)	9	18	1.83
Prohibit the use of portable heaters and other such high energy consuming small appliances. (30)	10	14	1.57
Reduce temperature of hot water. (29)	11	23	1.45
Open window coverings during day for heat and light and close during night. (30)	12	19	1.07
Weather strip all windows and doors. (29)	13	17	1.03
Reduce community use of buildings during after school hours. (30)	14	13	0.90
Schedule custodial care during day instead of night. (30)	15.5	12	0.83
Schedule extra-curricular events and community events simultaneously. (30)	15.5	15	0.83
Reduce athletic or special activity practices during after school hours (weekends, holidays, etc.). (30)	17	2	0.70
Prepare "cold" lunches occasionally. (30)	18	21	0.50
Reduce and control length of showers in locker rooms. (30)	19	22	0.43
Install storm windows (or double glaze) or reduce number of windows in school unit. (30)	20	4	0.37
Install double doors. (29)	21	16	0.34
Utilize heat recovery methods. (30)	22	5	0.23
Shorten school day by reducing lunch periods or activity periods. (30)	23	1	0.03

*Indicates the number who responded to the item.
**Averages could range from 0.00 to 4.00.

Heating energy conservation methods used most frequently. The three methods of heating energy conservation which each received a weighted average of between 3.00 and 4.00 were numbers 10, 20, and 6. Thus, the most frequently utilized methods (weighted average between 3.00 and 4.00) of heating energy conservation were: (1) reduce building temperature during holiday periods; (2) place stronger emphasis on proper maintenance of heating equipment; and (3) reduce building temperature. It should be noted that 93% or more of the respondents utilized to some extent the three methods of heating energy conservation described in Items 6, 10, and 20.

Heating energy conservation methods used with moderate frequency. The three methods of heating energy conservation which each received a weighted average of between 2.00 and 2.99 were numbers 7, 9, and 8. Those methods of heating energy conservation which were used with moderate frequency (weighted average between 2.00 and 2.99) were: (1) reduce temperature in specialized areas; (2) switch to night heating cycle before school closes for the day; and (3) delay building warm-up periods until closer to opening of school for the day. At least 70% of the respondents reported that the heating energy conservation methods described in Items 7, 8, and 9 were used to some extent in their respective school systems.

Part II-Perceived Success of Heating Energy Conservation Methods

Table 3 shows the frequency and percent of the rating of success of each of the 23 methods of heating energy conservation. (Each respondent was requested to rate on a scale of 1 to 5 the perceived success of each method of heating energy conservation utilized in his

school system.) For example, Table 3 shows that on Item 2, four (12.9%) respondents rated the method as 1, indicating very low success.

Table 5 shows the 23 methods of heating energy conservation ranked according to success ratings. A weighted average for each method was computed by assigning a weight of 1, 2, 3, 4, or 5 to each response. Thus, possible weighted averages could range from 1 to 5, 1 showing a method of low success and 5 indicating a highly successful method. The numeral in parentheses after each item shows the number of respondents who rated the success of the method. If a particular method was not used in a school system, the respondent did not rate the success of that method. The following discussion is based on the data displayed in Tables 3 and 5.

Highly successful methods of heating energy conservation. Four methods, numbers 10, 9, 12, and 20, of heating energy conservation each received a weighted average of between 4.00 and 5.00. Those methods of heating energy conservation which were rated as highly successful (weighted average between 4.00 and 5.00) were: (1) reduce building temperature during holiday periods; (2) switch to night heating cycle before school closes for the day; (3) schedule custodial care during day instead of night; and (4) place stronger emphasis on proper maintenance of heating equipment.

Moderately successful methods of heating energy conservation. Twelve methods, numbers 23, 5, 16, 7, 4, 8, 18, 6, 11, 3, 13, and 22, of heating energy conservation each received a weighted average of between 3.00 and 3.99, indicating that they were moderately successful

TABLE 5

RANK ORDER OF EACH METHOD OF HEATING ENERGY CONSERVATION ACCORDING TO SUCCESS RATING

Item	Rank	Item Number	Weighted Average**
Reduce building temperature during holiday periods. (27)*	1	10	4.52
Switch to night heating cycle before school closes for the day. (21)	2	9	4.33
Schedule custodial care during day instead of night. (7)	3	12	4.14
Place stronger emphasis on proper maintenance of heating equipment. (27)	4	20	4.00
Reduce temperature of hot water. (14)	5	23	3.93
Utilize heat recovery methods. (5)	6	5	3.80
Install double doors. (5)	7	16	3.60
Reduce temperature in specialized areas such as gymnasiums, auditoriums, etc. (23)	8	7	3.52
Install storm windows (or double glaze) or reduce number of windows in school unit. (6)	10	4	3.50
Delay building warm-up periods until closer to opening of school for the day. (20)	10	8	3.50
Insulate ducts, hot water pipes, ceilings, walls, etc. (20)	10	18	3.50
Reduce building temperature. (26)	12	6	3.46
Reduce heating in hallways. (17)	13	11	3.41
Conduct staff training workshops, relative to heating energy conservation methods. (7)	14	3	3.24
Reduce community use of buildings during after school hours. (10)	15	13	3.20
Reduce and control length of showers in locker rooms. (7)	16	22	3.14
Open window coverings during day for heat and light and close during night. (10)	17	19	2.90
Schedule extra-curricular events and community events simultaneously. (10)	18	15	2.80
Reduce athletic or special activity practices during after school hours (weekends, holidays, etc. (8)	19.5	2	2.75
Weather strip all windows and doors. (8)	19.5	17	2.75
Prohibit the use of portable heaters and other such high energy consuming small appliances. (14)	21	14	2.64
Prepare "cold" lunches occasionally. (5)	22	21	2.40
Shorten school day by reducing lunch periods of activity periods. (1)	23	1	2.00

*Indicates the number who rated the item.
**Averages could range from 1.00 to 5.00.

methods. Those methods of heating energy conservation which were rated as moderately successful were: (1) reduce temperature of hot water; (2) utilize heat recovery methods; (3) install double doors; (4) reduce temperature in specialized areas; (5) install storm windows or reduce number of windows; (6) delay building warm-up periods until closer to opening of school for the day; (7) insulate ducts, hot water pipes, ceilings, walls, etc.; (8) reduce building temperatures; (9) reduce heating in hallways; (10) conduct staff training workshops, relative to heating energy conservation methods; (11) reduce community use of buildings during after school hours; and (12) reduce and control length of showers in locker rooms.

Materials Received

Persons responding to the "Methods of Conserving Heating Energy" survey were requested to send any brochures, pamphlets or other materials relative to energy conservation in public school systems. A total of 22 documents were received from 12 school systems. A list of the materials received appears in Table 6. A file of these materials is available from the Division of Research and Planning, Memphis City School System, Memphis, Tennessee 38112.

Conclusions

The following conclusions are based on the survey responses received from 31 public school systems.

TABLE 6

LIST OF MATERIALS RECEIVED RELATIVE TO ENERGY CONSERVATION

Title/Description of Materials	Number of Pages	Publication Date	Provided By
1. Atlanta Public Schools - Policy to Conserve Energy and Natural Resources	2	Nov., 1975	Atlanta Public Schools Atlanta, Georgia
2. Atlanta Public Schools - Office of Energy Conservation Guidelines	2	Dec., 1975	
3. Office of Energy Conservation - Advisory Committee	1	Oct., 1975	
4. Charlotte-Mecklenburg Schools - Energy Conservation Plan - People Hold the Key to Energy Savings	2	Sep., 1975	Charlotte-Mecklenburg Sch. Charlotte, N. C.
5. Energy Facts, Figures, Comments	2	Sept., 1975	
6. Energy Conservation	2	Oct., 1975	
7. Energy Conservation Recommendations	3	Nov., 1975	Columbus Public Schools Columbus, Ohio
8. Natural Gas Monitoring System	2	Nov., 1975	
9. Air Conditioning Usage and Operation	2	Jul., 1975	Dallas Indep. School Dist. Dallas, Texas
10. Guidelines for Energy Conservation	7	Oct., 1975	Dekalb County Tucker, Georgia
11. Energy Conservation Measures for Duval County Public Schools	10	Dec., 1975	Duval Co. School Board Jacksonville, Florida
12. Revised Electrical Energy Curtailment Plan	3	Jun., 1974	Los Angeles City Bd. of Ed. Los Angeles, California
13. Energy Conservation Recommendations	4	Mar., 1974	Milwaukee Public Schools Milwaukee, Wisconsin
14. Computerized Energy Consumption Report	2	Sep., 1975	Minneapolis Public Schools Minneapolis, Minnesota
15. Energy Conservation (Letter)	2	Dec., 1975	New Orleans Public Schools New Orleans, Louisiana
16. Utility Bill Checklist, New Orleans Public Services, Inc.	3	Sep., 1975	
17. Energy Conservation in Existing Structures	2	Jun., 1974	
18. Computerized Ranking of Schools According to KWH, KWH per Square Foot	4	Sep., 1975	
19. Suggested Program for Fuel Crisis	2	Nov., 1973	New York City Bd. of Ed. Long Island City, New York
20. Oil Consumption Rates for the Year 1973/74 Tabulated In Order of Building Size - 1971/72 and 1972/73 Figures Given for Comparison (Sample Page)	1	Dec., 1974	
21. Energy Conservation	2	May, 1975	San Diego City Schools San Diego, California
22. Conservation of Energy	4	Oct., 1973	

1. Approximately 75% of the respondents represented school systems with student enrollments of between 60,000 and 140,000.

2. Approximately 75% of the respondents reported that the primary source of energy for heating purposes was natural gas. Electricity was a secondary source of heating energy used by approximately 84% of the school systems.

3. Approximately 87% of the respondents replied that their school systems' fuel allocation had not been reduced since the 1972-73 school year.

4. The three methods of heating energy conservation which were reportedly being utilized to the greatest extent were: (1) reduce building temperatures during holiday periods; (2) place stronger emphasis on proper maintenance of heating equipment; and (3) reduce building temperature.

5. The four methods of heating energy conservation which were perceived by the respondents to be the most successful were: (1) reduce building temperature during holiday periods; (2) switch to night heating cycle before school closes for the day; (3) schedule custodial care during day instead of night; and (4) place stronger emphasis on proper maintenance of heating equipment.

APPENDIX

December [illegible], 1975

Dear Business Manager:

Recently Memphis Light, Gas, and Water notified the Memphis City School System that it would be necessary for the school system to reduce its consumption of natural gas by as much as 25% during the period of November, 1975 through March, 1976. If the school system is not able to reduce its consumption of natural gas during these months, it faces paying a penalty of $5.80 per 1000 cubic feet of natural gas consumed above the alloted amount. The Memphis school system is probably not unlike other large school systems relative to the need to conserve heating energy or face additional utility costs.

In order to determine the methods used by other large public school systems to reduce their energy consumption and to reduce utility costs, the enclosed survey, "Methods of Conserving Heating Energy," was developed. The survey is being sent to approximately 45 large public school systems. It is requested that the survey be completed and returned in the enclosed self addressed envelope no later than Friday, December 19, 1975. If your school system would like to have a copy of the report which will be compiled by the Memphis school system, you should indicate to whom the report should be sent on the last page of the survey.

If you have any questions relative to the attached survey, please contact Ray Holt, Deputy Superintendent, Business Services at 901-454-5462 or Kathy Davis, Research Consultant, Division of Research and Planning, at 901-454-5333. Your cooperation in assisting the Memphis system in gathering and disseminating information relative to the efforts of large school systems in energy conservation is sincerely appreciated.

Sincerely,

John P. Freeman

SCHOOL SYSTEM: _____

Name of person responding to the questionnaire: _____

Position: _____

Phone number: _____

PART I

1. Number of students enrolled (ADA) for 1975-1976 school year _____.

2. Approximate number of school plants in your school system _____.

3. What is the school system's primary source of energy for heating purposes? (Please circle only one response.)

   a. natural gas
   b. propane gas
   c. fuel oil
   d. electrical
   e. coal
   f. other, please specify _____.

4. What other sources (other than the primary source) of energy for heating purposes are utilized? (Circle as many as apply.)

   a. natural gas
   b. propane gas
   c. fuel oil
   d. electrical
   e. coal
   f. other, please specify

5. Has the school system's fuel allocation been reduced since the 1972-73 school year? (Please circle either "Yes" or "No.")

   a. Yes
      If yes, by what percent was the fuel allocation reduced for each school year?

      percent reduced in 1972-73 _____
      percent reduced in 1973-74 _____
      percent reduced in 1974-75 _____
      percent reduced in 1975-76 _____

   b. No

6. If the school system has a fuel allocation what specific penalties will be imposed by the supplier if the allocation is exceeded?

_____

_____

_____

PART II

The following is a list of methods which may have been or are currently being used by your school system to conserve heating energy. Please respond to each method of energy conservation for your school system according to the following directions.

1. If the method is not and has not been used, please place an "X" in the 0% column (method not used at all).

2. If the method is being used or has been used, please place an "X" in (a) the column that indicates in approximately what percent of the school plants the method is used and (b) the column that indicates your opinion (on a scale of 1 to 5, low success to high success) of the success of the method in conserving heating energy for your system.

Method of Heating Energy Conservation	Percent of Schools the Method Is (Has Been) Used						Your Rating of the Success of the Method				
	Not Used 0%	1-25%	26-50%	51-75%	76-99%	100%	Low 1	2	3	4	High 5
1. Shorten school day by reducing lunch periods or activity periods.											
2. Reduce athletic or special activity practices during after school hours (weekends, holidays, etc.)											
3. Conduct staff training workshops, relative to heating energy conservation methods.											
4. Install storm windows (or double glaze) or reduce number of windows in school unit.											
5. Utilize heat recovery methods.											
6. Reduce building temperature.											
7. Reduce temperature in specialized areas such as gymnasiums, auditoriums, etc.											
8. Delay building warm-up periods until closer to opening of school for the day.											

Method of Heating Energy Conservation	Percent of Schools the Method Is (Has Been) Used						Your Rating of the Success of the Method				
	Not Used 0%	1-25%	26-50%	51-75%	76-99%	100%	Low 1	2	3	4	High 5
9. Switch to night heating cycle before school closes for the day.											
10. Reduce building temperature during holiday periods.											
11. Reduce heating in hallways.											
12. Schedule custodial care during day instead of night.											
13. Reduce community use of buildings during after school hours.											
14. Prohibit the use of portable heaters and other such high energy consuming small appliances.											
15. Schedule extra-curricular events and community events simultaneously.											
16. Install double doors.											
17. Weather strip all windows and doors.											
18. Insulate ducts, hot water pipes, ceilings, walls, etc.											
19. Open window coverings during day for heat and light and close during night.											
20. Place stronger emphasis on proper maintenance of heating equipment.											
21. Prepare "cold" lunches occasionally.											

Method of Heating Energy Conservation	Percent of Schools the Method Is (Has Been) Used						Your Rating of the Success of the Method				
	Not Used 0%	1-25%	26-50%	51-75%	76-99%	100%	Low 1	2	3	4	High 5
22. Reduce and control length of showers in locker rooms.											
23. Reduce temperature of hot water.											
24. Other, please specify _____											
25. _____											
26. _____											
27. _____											
28. _____											

29. Please include any additional printed materials relative to methods of energy conservation which might be helpful.

30. Would you like to have a copy of the results of this questionnaire?

_____Yes _____No

If yes, to whom should the copy be sent?

NAME_____

POSITION_____

SCHOOL SYSTEM_____

STREET ADDRESS_____

CITY, STATE, ZIP CODE_____

Return to:

Kathy E. Davis
Division of Research and Planning
Memphis City School System
2597 Avery
Memphis, TN 38112